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# (54) REPRODUCTION APPARATUS OPERATION DURING MALFUNCTION RECOVERY

WIEDERGABEAPPARAT, DER WÄHREND DER ERKENNUNG EINER FEHLFUNKTION ARBEITET

FONCTIONNEMENT D'APPAREIL DE REPRODUCTION PENDANT LE RETOUR A L'EXPLOITATION NORMALE

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(56) References cited:
**GB-A- 1 531 401**
**GB-A- 2 064 432**
**GB-A- 2 160 063**
**GB-A- 2 166 619**
**JP-A- 62 135 069**
**JP-A- 63 072 603**
**US-A- 4 774 591**

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## Description

BACKGROUND OF THE INVENTION

Technical Field

**[0001]** This invention relates generally to document reproduction apparatus, and more particularly to operation of the apparatus during recovery from a malfunction.

Background Art

**[0002]** Various types of system shut downs during malfunctions are known in the prior art. Generally, reproduction apparatus is put through either a so called "soft" or a "hard" shut down sequences. In a hard sequence, the machine essentially stops the production at the time of malfunction. In a soft sequence, reproductions in progress continue through the apparatus, but new reproductions are not started.

**[0003]** Parts of the machine may be subjected to a soft shut down and other parts to a hard shut down. For example, a copier having a recirculating document feeder experiencing a jam in the marking engine may effect a hard shut down of the engine and a soft shut down of the feeder. If the jam is in the feeder, the engine may carry out a soft shut down and the feeder a soft shut down. Regardless of whether the shut down is soft or hard, production ceases upon detection of the malfunction.

**[0004]** The document GB-A-2 166 619 discloses a memory which is used for storing received image data from a faximile or a computer during the operation of a printer for printing or copier job wherein after completion of the operation of the printer or the copier job, the image data stored in the memory is read out and a converting process of the received image data is performed on the basis of a predetermined system. Received information is stored and printed on recording material. The presence of the paper is sensed as is a jam condition. The reception of the image data in the memory is continued after a paper jam is detected. After the jam is cleared a print instruction is then generated so as to restart printing of data which is not yet recorded.

**[0005]** Another patent application, GB-A-2 160 063, features a printing device which possesses a main control unit for controlling the printing of a page of a sheet at a time and for receiving the printing data page by page from the main control unit. The device includes a number of page memories for storing temporarily this printing data, to be printed a page at a time, and a number of sensors which are arranged along the feed path of the sheets in the printing mechanism for determining the conditions of the sheets. The control unit is designed so that the printing data of each memory is held until the sheet printed with the data has passed all the sensors.

**[0006]** Reproduction apparatus is known in which a plurality of reproductions of a multiple page original can be made such that the reproduction pages are arranged in a collated sequence. In optical copiers, this has been accomplished by recirculating the original pages as often as necessary to produce the desired number of copy sets, or by means of mechanical sorters.

**[0007]** It is also known to do the collation by means of an electronic multiple page buffer memory into which electronic signals representative of the image content of a plurality of original pages are written; to be subsequently read from memory in a predetermined page sequence to produce a plurality of reproductions of the multiple page original in collated sequence. Such apparatus is described in commonly assigned British Patent Specification GB-A- 1,531,401 published on November 8, 1978.

**[0008]** It would be desirable to provide a sophisticated and efficient automatic malfunction recovery system that maximizes the operator's opportunities to use the apparatus for production during the recovery process.

Disclosure of Invention

**[0009]** It is an object of the present invention to provide for the efficient operation of reproduction during malfunction recovery while maintaining the integrity of a run in progress such that the run progresses as much as possible during the recovery operation.

**[0010]** This object is acheived by the features of claim 1.

**[0011]** The invention, and its objects and advantages, will become more apparent in the detailed description of the preferred embodiments presented below.

Brief Description of the Drawings

**[0012]** In the detailed description of the preferred embodiments of the invention presented below, reference is made to the accompanying drawings, in which:

Figure 1 is a perspective view of reproduction apparatus according to the present invention; and
Figure 2 is a schematic block diagram of reproduction apparatus of Figure 1.

Best Mode for Carrying Out the Invention

**[0013]** The present description will be directed in particular to elements forming part of, or cooperating more directly with, apparatus in accordance with the present invention. It is to be understood that elements not specifically shown or described may take various forms well known to those skilled in the art.

**[0014]** In this specification, the term "copier" is meant to refer to apparatus arranged for reading the image information on an original hard copy and for reproducing such image information on a receiver sheet. The term

"printer" is meant to refer to apparatus arranged for receiving image information in other than hard copy form and for reproducing such image information on a receiver sheet. The term "original" is meant to refer to image information to be reproduced, whether such image information is in hard copy, electronic, or other form. The term "reproduction apparatus" is meant to refer to copiers and/or printers.

**[0015]** According to Figures 1 and 2, reproduction apparatus 10 includes a marking engine 12, a scanner 14, a raster image processor 16, and a multiple input controller 18 for selecting the input to the marking engine.

**[0016]** A document reader such as a scanner 14 is arranged for producing a series of electrical signals representative of the image content of originals. Scanner 14 consists of an automatic document handler 20 for stream feeding multiple hard copy original pages to be automatically read by an image scanner 22 such as a linear array of solid-state charge-coupled devices. The solid state device scans the original pages, converting their images to a series of electrical signals in page format for input to marking engine 12. The image data may be manipulated by image processing electronics 24. Image processing by electronics 24 may include linearity correction, unsharp masking, image editing, windowing, document recognition, magnification, accent color, color substitution, and so on. The processed image data is transmitted along an image data bus 26 to multiple input controller 18. Syncronization signals to identify separate scan lines and to provide page information and marking engine control is transmitted along a job control communications link 28.

**[0017]** Scanner 14 also includes a control logic package 30 having an operator control panel 34 and digitizer 36. The control logic package is an interfacing medium for the operator to input functions and to receive messages from the reproduction apparatus. Setup instructions are input to the scanner, while information for finishing and processing of jobs will be sent to marking engine 12. The logic package consists of control software, interface software, and logic hardware.

**[0018]** As way of example only, functions inputted by the operator at the control panel may include image editing features such as area erase (blanking and framing), image shift, book copy modes, magnification, positive-to-negative image reversal, accent (spot) color, highlighting, forms overlay, screening selected areas for breaking a continuous tone original into dots for reproduction as half-tone images, etc.

**[0019]** Default machine setup instructions are stored in a ROM 38. In the copier mode, an operator uses control panel 34 and digitizer 36 to input setup instruction values for storage in a RAM 40. Alternatively, setup instructions may be received via removable memory media from an off line computer, or the like. The setup instructions are used by image processing electronics 24 to modify the image data from image scanner 22, or are transmitted as control signals to marking engine 12.

**[0020]** Raster image processor 16 includes a master processor unit 42 which receives high level commands and data in character code form from a main frame computer, network link, data processing work station, removable memory media, FAX, or the like. The commands are translated into machine control language by the master processing unit. A job buffer 44 stores incoming jobs and program codes for use by the master processing unit.

**[0021]** After interpreting a job, master processing unit 42 parcels the job to a mapper 46, which includes a font memory 48 for converting the character code data to a pixel pattern map. For color prints, the mapper separates the information into four raster patterns; one for each color available at marking engine 12. Mapper 46 may provide for character block moves, line drawing, trapezoidal fills, and windowing/clipping. It also includes a forms generator 50.

**[0022]** When the pixel pattern map is rasterized, mapper 46 sends page information to an output processor unit 52. The output processor unit has page memory 54, which stores image planes for transmission to marking engine 12. Preferably, there are two image plane stores so that one store can be being loaded while the other is being read to the marking engine. For use in a four color printer, one might want to provide eight image plane stores so that two four-color pages can be stored.

**[0023]** The processed image data is transmitted along an image data bus 56 to multiple input controller 18. Syncronization signals to identify separate scan lines and to provide page information and marking engine control is transmitted along a job control communications link 58.

**[0024]** Marking engine 12 receives bit stream image data over a bus 60 and job control data over a communications link 62, both for storage in a multiple page buffer memory 64 under the control of a memory management unit 65. Memory devices may be classified as being either "totally accessible" wherein simultaneous requests for access to two different addresses can be honored, or "not totally accessible" wherein only those addresses in a particular subset can be accessed at the same time. In the embodiment of reproduction apparatus as disclosed herein, the file maintenance problem is not solvable if only one "not totally accessible" memory is used since in normal operation the scanner (or the raster image processor) and the writer will generally not be working out of the same subset. Accordingly, job image buffer should preferably consist of two or more "not totally accessible" memories or at least one "totally accessible" memory.

**[0025]** Control means, including a micro controller 66 is arranged to perform arithmetic and logic operations and instruction decoding as well as controlling the time allocation of peripherals (such as a paper supply controller 68 and accessories 70) through a machine control communications link 72. Several output functions

may be available for receiver sheets, including selection of output trays, stapling, sorting, folding, finishing, mailbox, envelope receiver, etc.

**[0026]** After appropriate processing, the data is inputted to a writer interface 74 and a writer 76 for forming images on the receiver sheets.

**[0027]** As an example of the functions of the elements so far described, it will be assumed that an operator desires to make eight collated sets of copies of an original made up of, say, twenty pages stacked in automatic document handler 20. The operator sets control panel 34 accordingly. For purposes of this example, it will further be assumed that job image buffer 64 is fully capable of storing the information from at least the twenty original pages.

**[0028]** Now, control logic package 30 starts in a subroutine pre-programmed according to the switches on control panel 34 to command scanner 14 to begin operation. Automatic document handler 20 is activated to move a document into an exposure station of image scanner 22.

**[0029]** As the scanning progresses, data (including image information and control signals) are received by job image buffer 64. As subsequent original documents are scanned, the processes described above are repeated until all of the original documents have been scanned and the data therefrom stored in job image buffer 64. Because job image buffer 64 is totally accessible (or there are two or more not totally accessible buffers), data can be removed from job image buffer 64 and transmitted to the writer at the same time that data is being written to the buffer.

**[0030]** Micro controller 65 is pre-programmed with the capacity of job image buffer 64 and with a bookkeeping function to keep track of the data loaded into the memory. Document scanning will be interrupted if the job image buffer is full.

**[0031]** One function of multiple-page image buffer 64 is to store all the pages of a particular job so that plural sets of collated pages may be produced without rescanning the set of originals for each set produced. As such, automatic document handler 20 need not be capable of recirculating the original, but the present invention extends as well to reproduction apparatus having recirculating document handlers.

**[0032]** Even the best designed, operated, and maintained machine can malfunction from time to time. In reproduction apparatus, malfunctions occur, for example, due to paper jams, shortage of supplies such as image developer or receiver sheets, out of specification performance, etc. In prior art reproduction apparatus, a malfunction either in the portion of the apparatus that generates the signals representative of the image to be reproduced or in the writer portion of the apparatus has caused the shut down of the entire reproduction apparatus.

**[0033]** By the present invention, scanner 14 or raster image processor 16 sends image data and job processing instructions to marking engine 12, where the data and instructions are stored. Once the instructions and at least one page of image data has reached job image buffer 64, the writer begins production; reading data from buffer as needed.

**[0034]** Generally, there will be a plurality of pages stored in the buffer; either because the writer can not keep up with the rate that data is sent to it, or a plurality of sets of a multiple page original has been requested. Therefore, a malfunction in the scanner or raster image processor such that there is an interruption in the information flow to the marking engine does not necessarily shut down the operation of the marking engine. That is, upon a malfunction of the signal generating means, operation of the writer means can continue until the next page in the production sequence has not been stored in the buffer. As such, the writer continues to produce while the malfunction is corrected; greatly enhancing productivity of the system.

**[0035]** In a similar manner, a malfunction in the marking engine such that there is an interruption in the writer's ability to produce output does not necessarily shut down the operation of scanner 14 or raster image processor. That is, upon a malfunction of the writer means, operation of the signal generating means can continue until either the entire multiple page original is stored in job image buffer 64, or the buffer becomes full. Thus, the signal generating means continues to store data in buffer while the malfunction is corrected; also enhancing productivity of the system.

**[0036]** The invention has been described in detail with particular reference to preferred embodiments thereof, but it will be understood that variations and modifications can be effected within the scope of the invention.

## Claims

**1.** Reproduction apparatus for multiple page originals, said apparatus comprising:

A. means (14, 16) for generating a series of electrical signals representative of the image content of a plurality of original pages

B. an electronic multiple page buffer memory (64) for receiving and storing such a series of electrical signals;

C. means for writing such a series of electrical signals to said memory

D. writer means (74, 76) responsive to applied electrical signals for forming images on receiver sheets;

E. a processing unit (65, 66) for reading stored signals from the multiple page buffer memory in a predetermined page sequence, and for applying such signals to said writer means;

characterized by: means operative upon the occurence of a malfunction in said signal generat-

ing means for continuing operation of said writer means until the next page in the predetermined sequence, which is to be formed on said receiver sheets and which has not been stored in said buffer memory.

**2.** Reproduction apparatus for multiple page originals, according to claim 1, comprises means, operative upon the occurence of a malfunction in said writer (74, 76) means for continuing operation of said signal generating means (14, 16) only until the first to occur of (a) all of the original pages have been stored in said multiple page buffer memory (64) or (b) said multiple page buffer memory (64) is filled.

**3.** Reproduction apparatus for multiple page originals, according to claims 1 or 2, wherein said multiple page buffer memory (64) is totally accessible, whereby data can be removed from said multiple page buffer memory (64) and transmitted to said writer (74, 76) at the same time that data is being written to said multiple page buffer memory (64).

**4.** Reproduction apparatus for multiple page originals, according to claims 1 to 3, wherein said multiple page buffer memory stores all the pages of a particular job, whereby plural sets of collated pages are producable without resending electrical signals representing a repetition of the originals to the said multiple page buffer memory (64).

**Patentansprüche**

**1.** Reproduktionseinrichtung für Vorlagenstapel mit

A. Mitteln (14, 16) zum Erzeugen einer Folge elektrischer Signale, die die Bildinhalte der Einzelseiten des Vorlagenstapels beinhalten,
B. einem elektronischen Pufferspeicher (64) zum Empfangen und Speichern der Mehrseiten-Signalfolge,
C. Mitteln zum Einschreiben der Signalfolge in den Speicher,
D. Bilderzeugungsmitteln (74, 76), die von der Signalfolge abhängige Bilder auf Empfangsmaterialblättern erzeugen, und
E. einer Prozessoreinheit (65, 66) zum Auslesen gespeicherter Signale aus dem Mehrseiten-Pufferspeicher in einer vorbestimmten Seitenfolge, und zum Anlegen der Signale an die Bilderzeugungsmittel,

**gekennzeichnet durch** bei in den Signalerzeugungsmitteln auftretenden Störungen zur Wirkung gelangende Mittel zum Weiterführen des Betriebs der Bilderzeugungsmittel bis zum Erreichen einer in der vorbestimmten Seitenfolge enthaltenen und auf einem Empfangsmaterialblatt zu erzeugenden Seite, die nicht im Pufferspeicher gespeichert wurde.

**2.** Reproduktionseinrichtung nach Anspruch 1, gekennzeichnet durch bei in den Bilderzeugungsmitteln (74, 76) auftretenden Störungen zur Wirkung gelangende Mittel zum Weiterführen des Betriebs der Signalerzeugungsmittel (14, 16), bis entweder (a) die Bildinhalte sämtlicher Vorlagenseiten im Mehrseiten-Pufferspeicher (64) gespeichert worden sind oder (b) der Pufferspeicher (64) voll ist.

**3.** Reproduktionseinrichtung nach Anspruch 1 oder 2, dadurch gekennzeichnet, daß der Mehrseiten-Pufferspeicher (64) voll zugriffsfähig ist, so daß während des Einlesens von Daten das Auslesen von Daten aus dem Pufferspeicher (64) und deren Übermittlung an die Bilderzeugungsmittel (74,76) erfolgen kann.

**4.** Reproduktionseinrichtung nach den Ansprüchen 1 bis 3, dadurch gekennzeichnet, daß der Mehrseiten-Pufferspeicher sämtliche Seiten eines bestimmten Auftrags speichert, wobei mehrere Sätze kollationierter Seiten herstellbar sind, ohne daß eine jeweils wiederholte Rückübermittlung von die Vorlagen beinhaltenden Signalfolgen an den Pufferspeicher (64) erfolgt.

**Revendications**

**1.** Appareil de reproduction d'originaux à plusieurs pages, l'appareil comprenant:

A) un dispositif (14, 16) destiné à créer une série de signaux électriques représentatifs du contenu d'images de plusieurs pages d'original,
B) une mémoire tampon électronique (64) de plusieurs pages destinée à recevoir et mémoriser une telle série de signaux électriques,
C) un dispositif destiné à écrire une telle série de signaux électriques dans la mémoire,
D) un dispositif (74, 76) à organe d'écriture commandé par les signaux électriques appliqués et destiné à former des images sur des feuilles réceptrices, et
E) une unité de traitement (65, 66) destinée à lire des signaux mémorisés dans la mémoire tampon de plusieurs pages suivant une séquence prédéterminée de pages, et à appliquer ces signaux au dispositif à organe d'écriture,

caractérisé par un dispositif qui, à la suite d'une défaillance du dispositif générateur de signaux, est destiné à poursuivre le fonctionnement du dispositif à organe d'écriture jusqu'à la page suivante de la

séquence prédéterminée qui doit être formée sur les feuilles réceptrices, et qui n'a pas été mémorisée dans la mémoire tampon.

**2.** Appareil de reproduction d'originaux à plusieurs pages selon la revendication 1, qui comprend un dispositif qui, lors de l'apparition d'un défaut de fonctionnement dans le dispositif à organe d'écriture (74, 76), assure la poursuite du fonctionnement du dispositif générateur de signaux (14, 16) uniquement jusqu'à l'apparition du premier des deux événements suivants: (a) toutes les pages de l'original ont été mémorisées dans la mémoire tampon (64) de plusieurs pages, et (b) la mémoire tampon (64) de plusieurs pages est pleine.

**3.** Appareil de reproduction d'originaux à plusieurs pages selon la revendication 1 ou 2, dans lequel la mémoire tampon (64) de plusieurs pages est totalement accessible, si bien que des données peuvent être retirées de la mémoire tampon (64) de plusieurs pages et transmises à l'organe d'écriture (74, 76) en même temps que des données sont écrites par la mémoire tampon (64) de plusieurs pages.

**4.** Appareil de reproduction d'originaux à plusieurs pages selon les revendications 1 à 3, dans lequel la mémoire tampon de plusieurs pages mémorise toutes les pages d'une tâche particulière, si bien que plusieurs jeux de pages classées peuvent être produits sans nouvelle transmission de signaux électriques représentant une répétition des originaux à la mémoire tampon (64) de plusieurs pages.

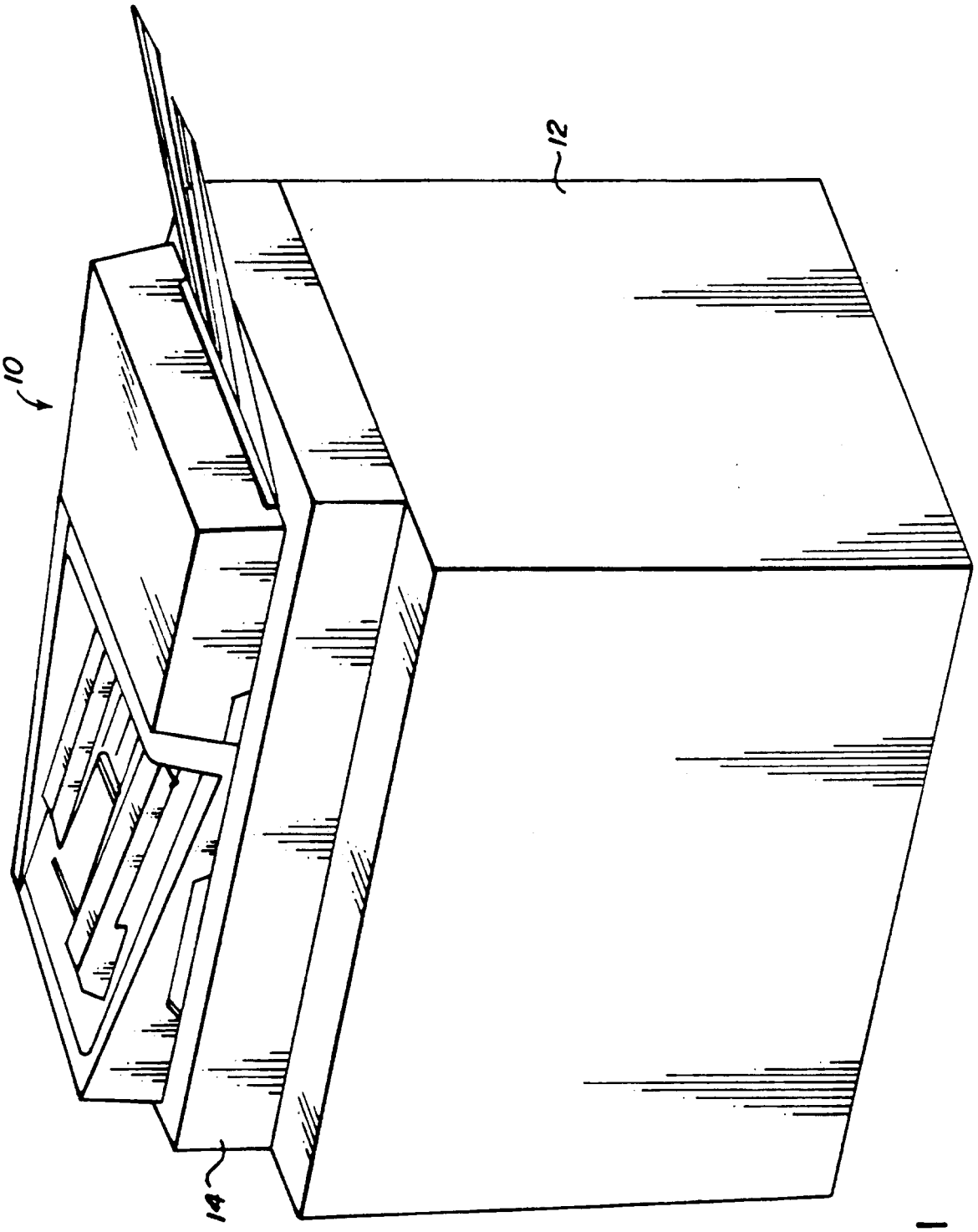


FIG. 1

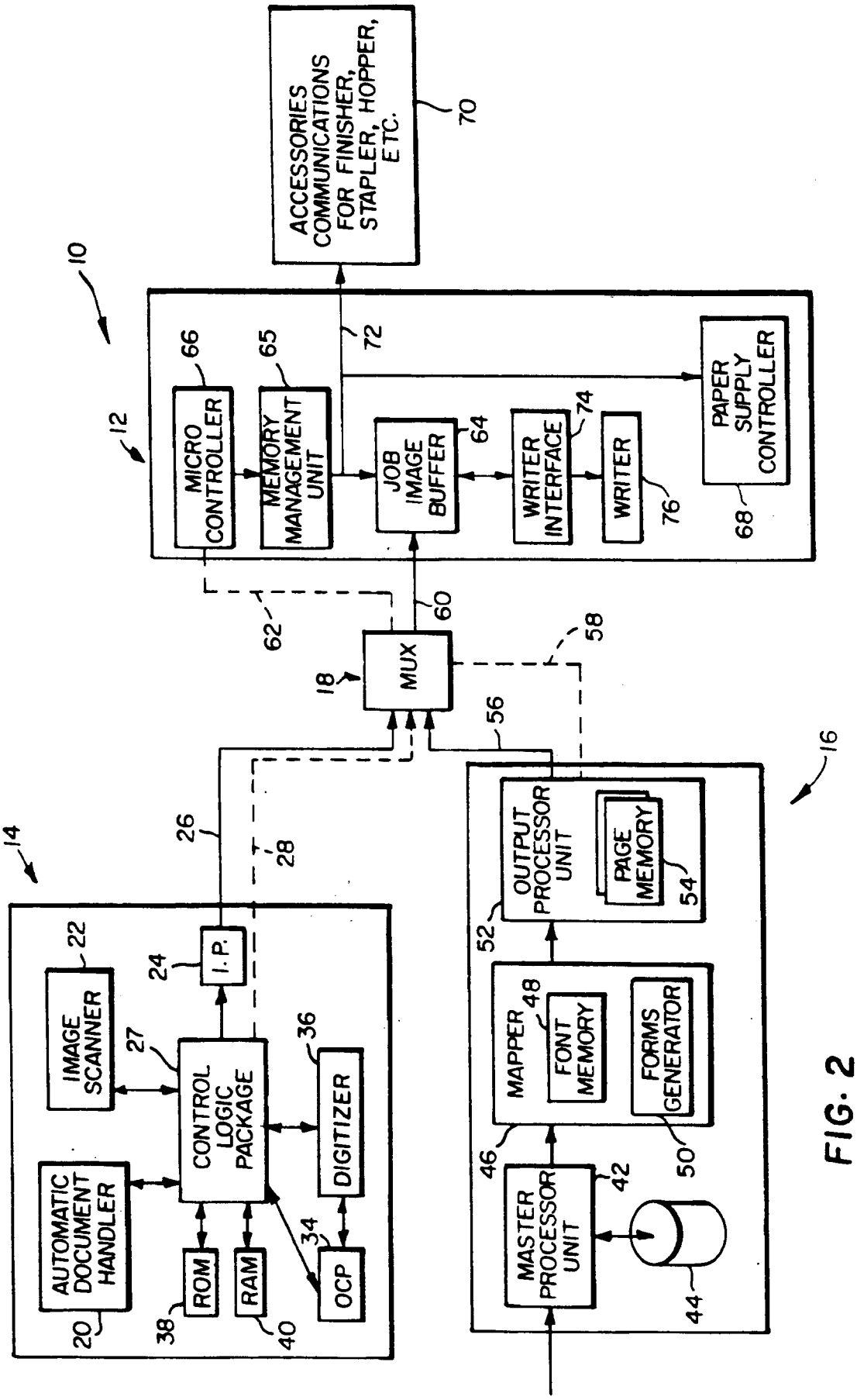
ACCESSORIES COMMUNICATIONS FOR FINISHER, STAPLER, HOPPER, ETC.
70
10
12
MICRO CONTROLLER
66
MEMORY MANAGEMENT UNIT
65
72
JOB IMAGE BUFFER
64
WRITER INTERFACE
74
WRITER
76
PAPER SUPPLY CONTROLLER
68
62
60
MUX
18
58
56
14
26
28
16
IMAGE SCANNER
22
I.P.
24
27
CONTROL LOGIC PACKAGE
36
DIGITIZER
AUTOMATIC DOCUMENT HANDLER
20
ROM
38
RAM
40
OCP
34
OUTPUT PROCESSOR UNIT
52
PAGE MEMORY
54
MAPPER
48
FONT MEMORY
FORMS GENERATOR
46
50
MASTER PROCESSOR UNIT
42
44

FIG. 2